

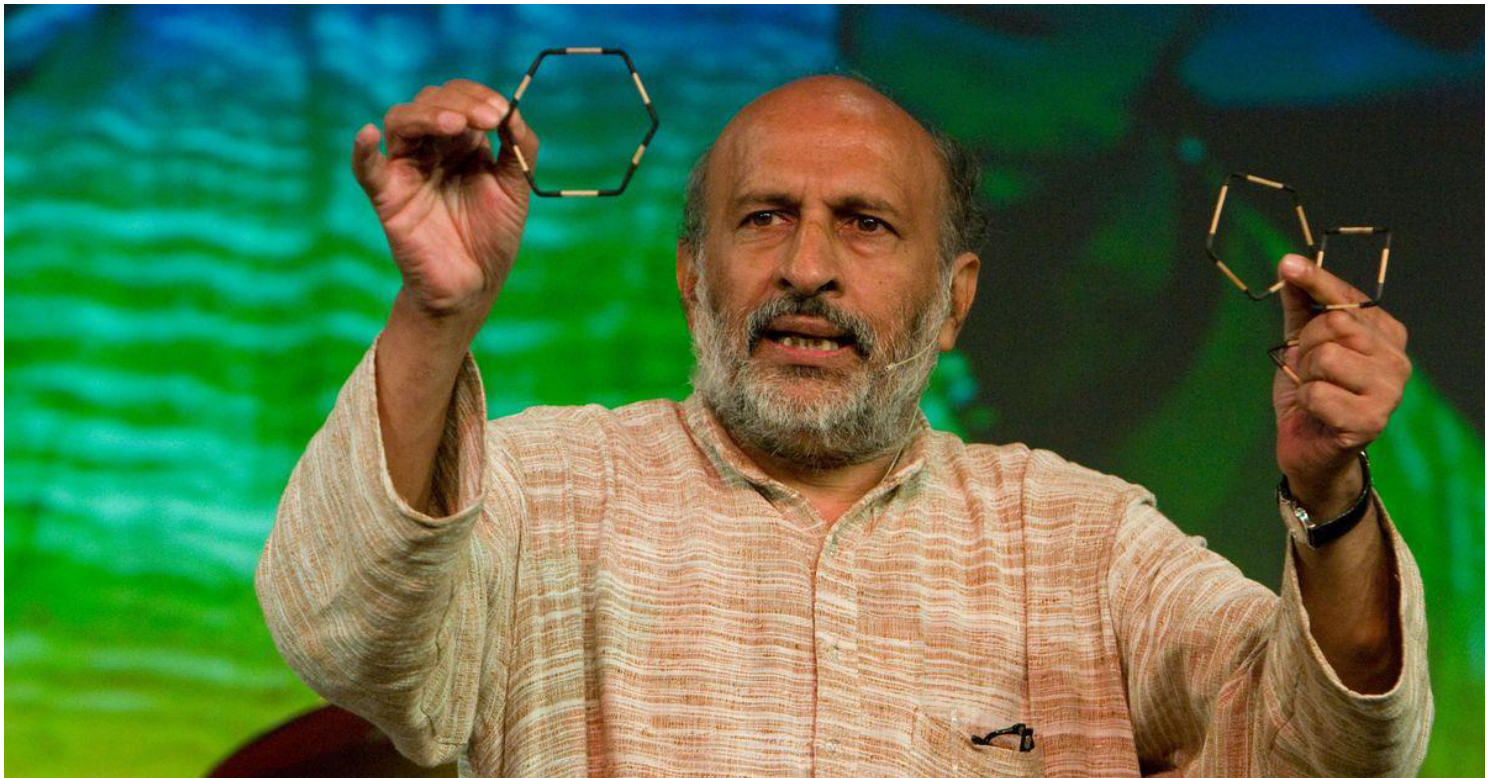
INTERVIEW

Allow children freedom to break things – that is how they will learn, says toymaker Arvind Gupta

The IIT-trained engineer was awarded the Padma Shri for his contribution to education this year.

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Arvind Gupta demonstrating his matchstick models | Arvind Gupta

Arvind Gupta owes much to matchsticks. With those and rubber tubes, he first started creating shapes, then complex models. That was in 1978. Four decades later, his craft has yielded thousands of educational toys from odds and ends, and fetched him the Padma Shri, one of the highest civilian awards conferred by the Government of India.

Gupta trained as an electrical engineer at the Indian Institute of Technology, Kanpur, and went to work for an automobile company. Two years later, he took a year's leave to volunteer with an education programme in Bankhedi block of Hoshangabad district, Madhya Pradesh. Scouting for material to

make teaching aids and toys at a village market, he bought 10 feet of rubber valve tube used for inflating bicycle tyres for one rupee. It would prove to be most useful, especially once he realised that matchsticks fit “very snugly” into it, allowing for flexible joints. Now, even the poorest children could learn science as they built – or dismantled – the “matchstick models”.

Over the next 40 years, Gupta’s matchstick models and “toys from trash”, as he describes them, would become a testament to how learning could be made fun even with minimum resources. He wrote dozens of books on the subject, made over a 1,000 instructional videos, conducted workshops at 3,000 schools, was a frequent science fair invitee and in 2011 delivered a TED Talk – a brief lecture organised by TED, a non-profit dedicated to spreading ideas. Barely days before his name was announced for the Padma Shri, he was honoured with the **Narendra Dhabolkar Memorial Award**, named after the rationalist scholar murdered in 2013, by the Maharashtra Foundation on January 13.

The Hoshangabad Science Teaching Programme where Gupta cut his teeth is widely considered the **most progressive** experiment in science teaching ever attempted. Aimed at improving science teaching in public schools by inciting curiosity and interest in children, the programme trained teachers, published books and designed science kits. It was shut down in 2002 by the Congress-run government of Madhya Pradesh and the Bharatiya Janta Party had **opposed** it throughout. But nearly all of the country’s most progressive education reforms, including the National Curriculum Framework 2005 and provisions of the Right to Education Act 2009, are redolent of its influence.

Gupta left Hoshangabad within a year in 1978, but continued to be associated with the programme for years. From 2003 till his retirement in December 2014, he was in charge of the Children’s Science Centre at the Inter-University Centre for Astronomy and Astrophysics in Pune. There, he started making his books and videos available **online**.

Gupta spoke to *Scroll.in* about being inspired by student protests, about the profound impact that hearing the firebrand education activist Anil Sadgopal speak in his college had on him, and about toys, trash and science learning. Excerpts:

You often say, “The best thing a child can do with a toy is to break it”. Could you explain this motto?

All children are born tinkerers. They want to make things, break things. Why do children break toys? Because they are the only curious cats left. They want to dismantle things, see what the innards are and put them back again. Allow children the freedom to break because unless you teach them how things work, how will they discover the laws of nature?

You have spoken about the influence political movements of the 1960s and 1970s had on you. How did they shape your life and work?

I was in IIT Kanpur from 1972 to 1975. In 1968, students were out on the streets of Paris protesting against the authorities. It was a very revolutionary time. Abroad, there were the women’s rights movement, the civil rights movement, the environment movement. In India, we had the Naxalbari

movement, followed by Jai Prakash Narayan's. There was an incredible churning in society, political churning, which unleashed a lot of energy.

Also, it was 20 years after the Second World War and many scientists were thinking about their own role in society. Many decided they would have nothing to do with killing human beings, they wouldn't make bombs and missiles.

One scientist, Anil Sadgopal, had completed his PhD at California Institute of Technology, returned and joined the Tata Institute of Fundamental Research, Pune. He gave it up and started one of the first Indian NGOs, Kishore Bharati, in Bankhedi, Hoshangabad, in the early 1970s. He found that no village school had a science lab. All science was learnt by rote and children went from one class to the next without dirtying their hands. This is a very mutilating way of learning science. Professor Yash Pal came as a teacher trainer in 1972, conducted a training programme for 40 teachers over 15 days. That is how the Hoshangabad Science Teaching Programme started.

And how did you get involved?

I was privileged to hear Sadgopal speak at IIT Kanpur in my second or third year. The lecture had a remarkable effect on me. Had I not heard him, I would probably be working in a big corporation or in America.

Sadgopal said his organisation had been working there (Hoshangabad) for several years and that the terrain was tough. People were not interested in getting [rural] children schooled because they would be cheap labour. It was such an honest admission, it hit me very hard. He said they had been trying very hard but not been able to make inroads.

I graduated and joined Telco (now Tata Motors, an automobile manufacturer). The first two years were fantastic but then things starting to get boring. I took a year's leave in '78 and went to Bankhedi. The state government had allowed the programme to run in 16 schools for five years, to see what the possibilities were of teaching sciences well.

I am a tinkerer, I am fascinated by materials. For the first month, I made just matchstick models. It is like a homespun Meccano (construction) set. You can make a house, you can make molecular structures. I thought, "This is so much better than making trucks!"





Arvind Gupta showing one of his matchstick models.



Were you always a tinkerer?

All my life. My parents were not educated but my mother came from a very educated family, her brothers had made it big and she understood the value of education. I am the youngest of four siblings and she packed all of us to the best convent school in Bareilly. We could not afford expensive toys so we were always tinkering, making things with matchboxes, cigarette packs, buttons and shoe polish tins. A rich relative had gifted me a Meccano set and I played with that for years.

At IIT, a friend and I constituted the aero-modelling club and repaired small engines. I learnt a lot from my friends who were much more skilled than me.

After six months at Hoshangabad, I went to Thiruvananthapuram. As a student I had read about Laurie Baker and thought he was a man who had touched the lives of the poor. I gave him a set of my matchstick models and he permitted me to work with him for a few months. I came back to Telco and worked for a few more years but that one year in the field left me with too many questions and I resigned.

What questions were these?

We were drawn to Gandhi and Marx. We asked the fundamental questions that would strike any sensitive person. Why was there so much poverty? Why do people who do manual labour get so few calories? Why are there such inequities in society?

I worked with a few other organisations but in 1984, I came back to Pune when my daughter was born. I wrote to Professor Yash Pal, who was then secretary of the Department of Science and Technology and got a fellowship to write my first book. *Matchstick Models and Other Science Experiments* came out in 1987. In two-three years, it was out in 12 Indian languages.

When I resigned, my uncles, who were in very high positions, were very critical of me. But my mother said, “Achcha kara hai naukri chhodi, ab kuch nek kaam karega (Good he has quit, now he will do something worthwhile).” That has propelled me all these years.

What work did you do with Eklavya, the organisation that ultimately came to run the Hoshangabad Science Teaching Programme?

Eklavya started in 1983-'84 and printed many of my books. I had kept writing. In 1990, we shifted to Delhi and I was a freelancer writing books, making films for Doorsharshan and holding workshops. We spent 14 years in Delhi until our daughter finished her Class 12 and went to study medicine in Vellore. We returned to Pune in 2003.

Did you launch your website and start posting videos in this period?

As soon as I was back in Pune, I was invited by Professor Jayant Narlikar (an astrophysicist) to work at the Children's Science Centre at the Inter-University Centre for Astronomy and Astrophysics. He had written extensively for students in Marathi and his dream was to have a small children's centre at the institute to catch them young, imbue them with a love of science. I worked there for 11 years and had a great team. Vidula Mhaiskar, a molecular biologist, came back from Stanford University after four years of post-doctoral research, joined the centre and stuck around for 11 years. And Ashok Rupner, from a small village near Anna Hazare's village Ralegaon Siddhi joined us too. We created over 1,500 toys – we do not call them science experiments – from trash. There are 110 experiments with old plastic bottles, 60 with drink boxes. You can transform all kinds of modern junk into absolutely stupendous toys, dynamic ones that make sounds or fly. Our website has instructions with photographs.

We posted over 8,600 videos on YouTube; 1,100 in English and dubbed in 18-20 languages, including Marathi and Hindi. There are over a hundred in Chinese and over 300 in Spanish, dubbed by volunteers.

The Hindi ones have been dubbed by me and all the Marathi ones by Mhaiskar. PK Nanavati, who worked with Narendra Dhabolkar, dubbed over 1,000 videos in Kannada.

There are also almost 5,000 books on the website – on education, environment, anti-war literature, science, maths – in Hindi, Marathi and English.

What do you make of how innovation in classroom is now interpreted as technological intervention, digital boards and e-content, especially by the government?

Much of the digitisation I have seen has consisted of scanned textbooks. This is hardly creative, it is nonsensical. People do not apply their minds at all. What we have done is have traditional categories in science and created toys for each. For instance, there are 50 toys for sound. The teacher and student can pick the right level of project. We must look into our own garbage cans, the materials used must make sense to our children and they must be accessible to the poorest. That is a very important part of innovation.

But this government has taken one great initiative – Atal Tinkering Labs. These are not curriculum-based and their purpose is to have kids come down and create things. If it does not work, you work on it till it does.

Since the Hoshangabad days, you have worked with several educationists who went on to frame education policies and advise the government.

I wrote to Anil Sadgopal today. Professor Yash Pal, who had granted me a fellowship to write my first book, later headed the committee that wrote the National Curriculum Framework, 2005. Vinod Raina was my publisher at Eklavya, which he co-founded. Later, we worked together on Bharat Gyan Vigyan Samiti, which too he co-founded and for which I did a series of 100 books. He later worked on the Right to Education. I had a great collaboration with Vinod.

Are you disappointed that some of their effort is being undone now?

I think there is a lot of concern about this. But a good thing is that material is being made accessible on the internet.

The Hoshangabad project was shut down too. And it was unpopular with the BJP from the start.

But it was the Congress government – Digvijay Singh was the chief minister – which finally shut it down. Many people say the Congress scored a self-goal there.

The project had pioneered things like open book tests in which we did not assess the ability to cram but focused on the understanding of concepts. People were opposed to this. They accused Eklavya of encouraging cheating. Eklavya was also a bit naive – for such a big programme, you need a good public relations machinery which, I think, they lacked. You have to take everyone aboard, diverse political formations and opinions.

You seem an unlikely candidate for this government to pick, judging by your vision of science teaching, the people you have worked with and been influenced by.

I have not been keeping track of Padmas but the prime minister said in his *Mann Ki Baat* that now there are many more people who are unsung on the list, that the government looked at the work and not the name. Maybe I fell in that little slot. But I felt nice after this recognition.

What have you been doing since you retired in 2014?

I translate children's books. I am fascinated by them. Last year, I translated 35 books on special children. These are beautiful illustrated books that are about 40 pages, with 70% pictures. I can translate a book in two days. Last year, I translated 170 books into Hindi and put them in the archive on our website. We will all die one day but we must leave a slightly better world for the next generation.